N5

National Qualifications
SPECIMEN ONLY

Mark

S844/75/01

Applications of Mathematics
Paper 1 (Non-calculator)

Date — Not applicable

Duration — 1 hour 5 minutes

S8447501

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day   Month   Year   Scottish candidate number

Total marks — 45

Attempt ALL questions.

You must NOT use a calculator.

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.
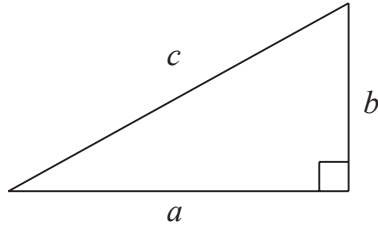
SQA

S8447501 01

FORMULAE LIST

Circumference of a circle: $C = \pi d$

Area of a circle: $A = \pi r^2$

Theorem of Pythagoras:

$$a^2 + b^2 = c^2$$

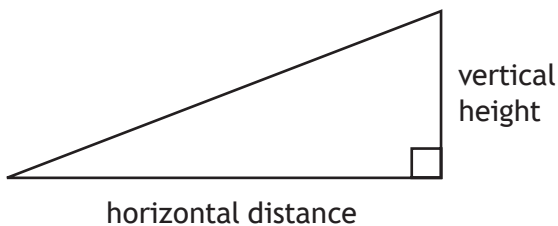Volume of a cylinder: $V = \pi r^2 h$

Volume of a prism: $V = Ah$

Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

Volume of a sphere: $V = \frac{4}{3}\pi r^3$

Standard deviation: $s = \sqrt{\dfrac{\Sigma(x-\overline{x})^2}{n-1}} = \sqrt{\dfrac{\Sigma x^2 - (\Sigma x)^2 / n}{n-1}}$, where n is the sample size.

Gradient:

$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

Total marks — 45

Attempt ALL questions

1. Liam is on holiday in New York.

He looks at the world time app on his phone.

The display shows the times below:

His flight to Glasgow departs New York at 8:00 am local time.

The flight time is 6 hours 30 minutes.

Calculate the local time when the plane lands in Glasgow.

2

2. S6 pupils were asked to choose their favourite subject.

The results are shown in the table below.

Subject	Boys	Girls
Geography	11	7
French	9	14
Maths	18	13
Spanish	10	12
Modern Studies	18	8
Total	66	54

Calculate the probability that a boy from this group chose French as his favourite subject.

Give your answer as a fraction in its simplest form.

2

3. A company orders a bag of washers with a thickness of $2\cdot4 \pm 0\cdot05$ mm.

An inspector takes a sample from the bag of washers.

The thicknesses, in mm, of the washers in this sample are shown below.

2·44, 2·37, 2·36, 2·45, 2·35

2·35, 2·44, 2·43, 2·34, 2·40

2·40, 2·41, 2·39, 2·38, 2·46

2·41, 2·39, 2·53, 2·36, 2·37

For the bag to be accepted, at least 88% of the washers in this sample must be within tolerance.

Will the bag be accepted?

3

4. The table below shows the vehicle tax to be paid on different vehicles.

The amount of vehicle tax paid depends on the CO_2 emissions of the vehicle and the fuel type.

		Tax for Petrol and Diesel Cars				
		Non Direct Debit		Direct Debit		
Bands	CO_2 emission figure (g/km)	12 months	Six months	Single 12 month payment	Total payable by 12 monthly instalments	Single six month payment
Band A	Up to 100	£0	–	–	–	–
Band B	101 to 110	£20	–	£20	£21	–
Band C	111 to 120	£30	–	£30	£31·50	–
Band D	121 to 130	£110	£60·50	£110	£115·50	£57·75
Band E	131 to 140	£130	£71·50	£130	£136·50	£68·25
Band F	141 to 150	£145	£79·75	£145	£152·25	£76·13
Band G	151 to 165	£180	£99	£180	£189	£94·50
Band H	166 to 175	£205	£112·75	£205	£215·25	£107·63
Band I	176 to 185	£225	£123·75	£225	£236·25	£118·13
Band J	186 to 200	£265	£145·75	£265	£278·25	£139·13
Band K	201 to 225	£290	£159·50	£290	£304·50	£152·25
Band L	226 to 255	£490	£269·50	£490	£514·50	£257·25
Band M	Over 255	£505	£277·75	£505	£530·25	£265·13

Tom buys a petrol car which has a CO_2 emission figure of 142 g/km.

Tom decides to pay his vehicle tax by direct debit in two single six month payments.

How much more expensive is this than a single 12 month payment by direct debit?
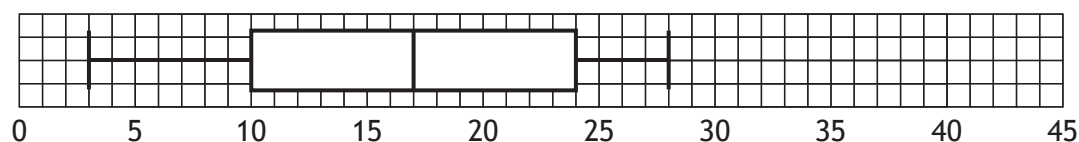
3

5. This back-to-back stem and leaf diagram represents the number of hours a class spends on social networking websites in a week.

Girls		Boys
	0	3 6 8 9
8 4 3 0	1	1 2 4 7 7 8 9
9 8 7 6 2 2 1	2	2 6 7 8 8
7 2 0	3	
2	4	

n = 15   n = 16

KEY

3 | 1 | represents 13 hours
| 2 | 5 represents 25 hours

(a) A boxplot is drawn to represent one set of data.

Which set of data does this represent?

Give a reason for your answer.   **1**

(b) For the other set of data, state:

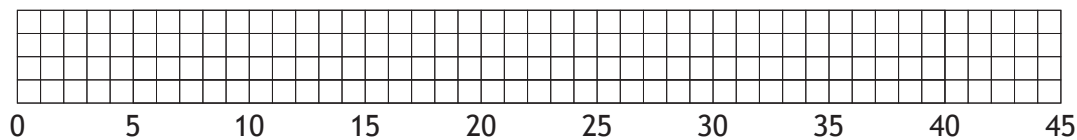the median

the lower quartile

the upper quartile.   **2**

5. **(continued)**

(c) Construct a box plot for the second set of data. **2**

(An additional diagram, if required, can be found on *page 16*.)

```
0     5     10    15    20    25    30    35    40    45
```

6. Mo is an electrician.

The table below shows the hours that Mo worked last week.

Monday	09:00 to 12:30	13:30 to 18:00	
Tuesday	09:00 to 12:30	13:30 to 18:00	
Wednesday	09:00 to 12:30	13:30 to 18:00	18:30 to 21:30
Thursday	09:00 to 12:30	13:30 to 18:00	18:30 to 21:30
Friday	09:00 to 12:30	13:30 to 18:00	

His basic hourly rate is £15·60.

Hours worked between 6 pm and 7 am are paid at time and a half.

Calculate his gross pay for last week. **3**

7. Jack is going to a festival in the Czech Republic from his home in Glasgow.

His mum orders the tickets costing 1500 Czech Koruna.

His mum lives in Poland so he must pay her back in Polish Zloty.

Rates of exchange	
Pounds Sterling (£)	**Other Currencies**
1	30·00 Czech Koruna
1	4·96 Polish Zloty

Calculate how many Polish Zloty he must give to his mum. **2**

8. A class of pupils were asked about how they travelled to school on a particular day.

- $\frac{1}{6}$ of the pupils were driven to school in a car.

- $\frac{2}{5}$ of the pupils took the bus.

- The rest of the pupils walked to school.

Calculate the fraction of pupils who walked to school.   **3**

9. It takes 5 bakers 3 hours to decorate a tray of cupcakes.

All the bakers work at the same rate.

Calculate the time taken for 4 bakers working at this rate to decorate the same number of cupcakes.

Give your answer in **hours and minutes**.   **3**

10. Canoeists in Scotland use water level data to decide if there is enough water in a river to canoe down it.

The data for the River Tweed is shown below.

Table 1

Time	Water Level (metres)
Friday 2015	1·55
Friday 2200	1·58
Friday 2315	1·67
Saturday 0015	1·70
Saturday 0100	1·88
Saturday 0300	1·97
Saturday 0415	2·05

Water Level on River Tweed
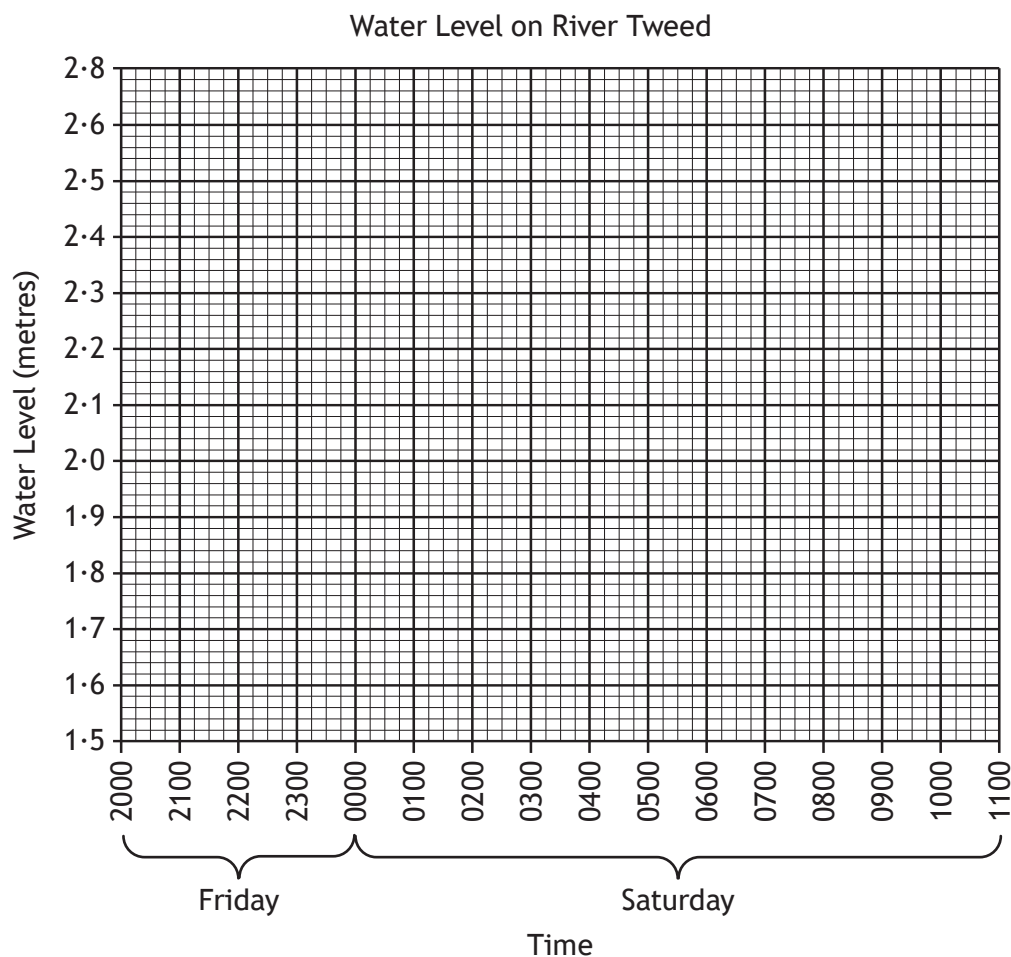
(a)　(i)　Plot the water levels on the scattergraph.　　　　2

　　　(ii)　Draw a line of best fit on the scattergraph.　　　　1

(An additional graph, if required, can be found on *page 16*.)

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page 10

10. (continued)

(b) The water level is predicted to rise at the same rate until 1100 on Saturday.

The canoeists use their line of best fit to predict the water level of the River Tweed at 0830 on Saturday.

They hope that it will be "Very High".

Table 2

River Tweed	
Water level:	
Huge	> 3·5
Very High	2·5 - 3·5
High	2·0 - 2·5
Medium	1·7 - 2·0
Low	1·2 - 1·7
Scrapeable	0·0 - 1·2
Empty	never

Will the Tweed be "Very High" at 0830?

Justify your answer.

2

11. Mhairi bought 200 shares for £700.

She decides to sell them, but the share price has dropped to £2·75 per share.

She also has to pay a fee of 2½% of her selling price when she sells her shares.

Calculate the loss that she has made. **4**

12. The diagram shows a planned zip line for a play park.

```
        start
                                    Zip line
        17 m                                              end
                                                           2 m
                            200 m
```
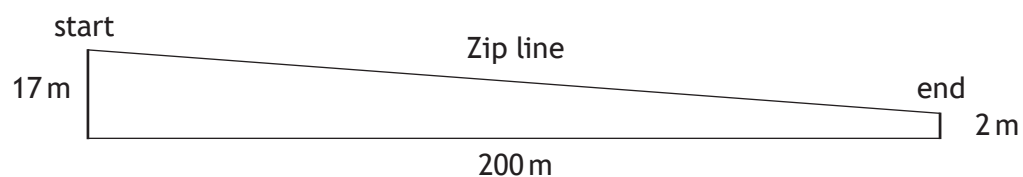
It is recommended that the average gradient of the zip line should be between 0·06 and 0·08 to be safe.

Does the planned zip line meet these safety recommendations?

Use your working to justify your answer.

3

13. Joe buys a plot of land in the shape of a rectangle and a semi-circle, as shown below.

8 m

20 m
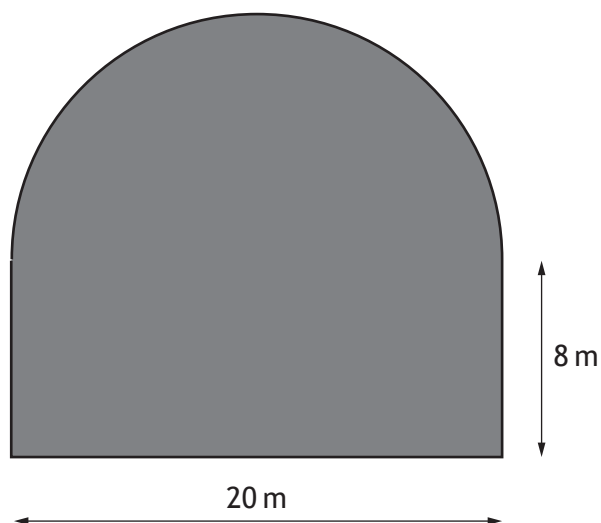
He plans to put a fence around the plot of land.

He employs Fence Direct to build the fence.

Fence Direct charges £15 per metre including all materials and labour.

(a) Calculate the cost of the fence. **3**

Take $\pi = 3 \cdot 14$.

(b) Fence Direct provides a team of workers to build the fence.

The table shows the list of tasks and the time taken to complete them.

Task	Detail	Preceding Task	Time (hours)
A	Take down old fence	None	2
B	Measure length of fence needed	None	0·5
C	Mark on the ground where new posts must go	None	0·5
D	Collect materials and tools from yard	B	1
E	Hammer posts into the ground	A, C, D	4
F	Attach metal fencing to posts	E	2
G	Attach barbed wire to top of posts	F	1
H	Gather up rubbish	G	2
I	Gather up tools	G	0·5
J	Take rubbish to recycling centre	H	1
K	Put tools back in yard	I	0·5

Complete the diagram below by writing these tasks and times in the boxes. **2**
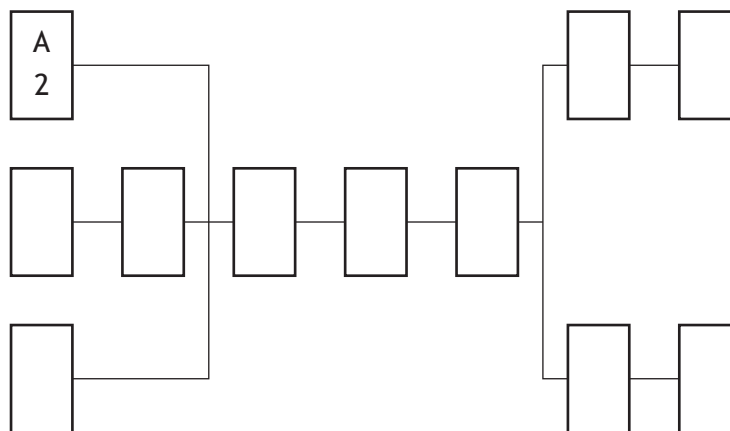
(An additional diagram, if required, can be found on *page 17*.)

(c) Fence Direct claims that all of these tasks can be completed in 10 hours.

Is this a valid claim?

Use your working to justify your answer. **2**

ADDITIONAL SPACE FOR ANSWERS

Additional diagram for Question 6 (c)

0　　　5　　　10　　　15　　　20　　　25　　　30　　　35　　　40　　　45
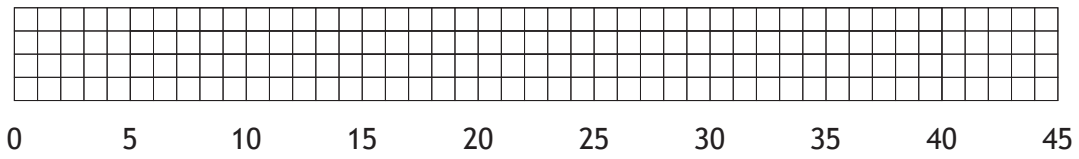
Additional graph for Question 10 (a)
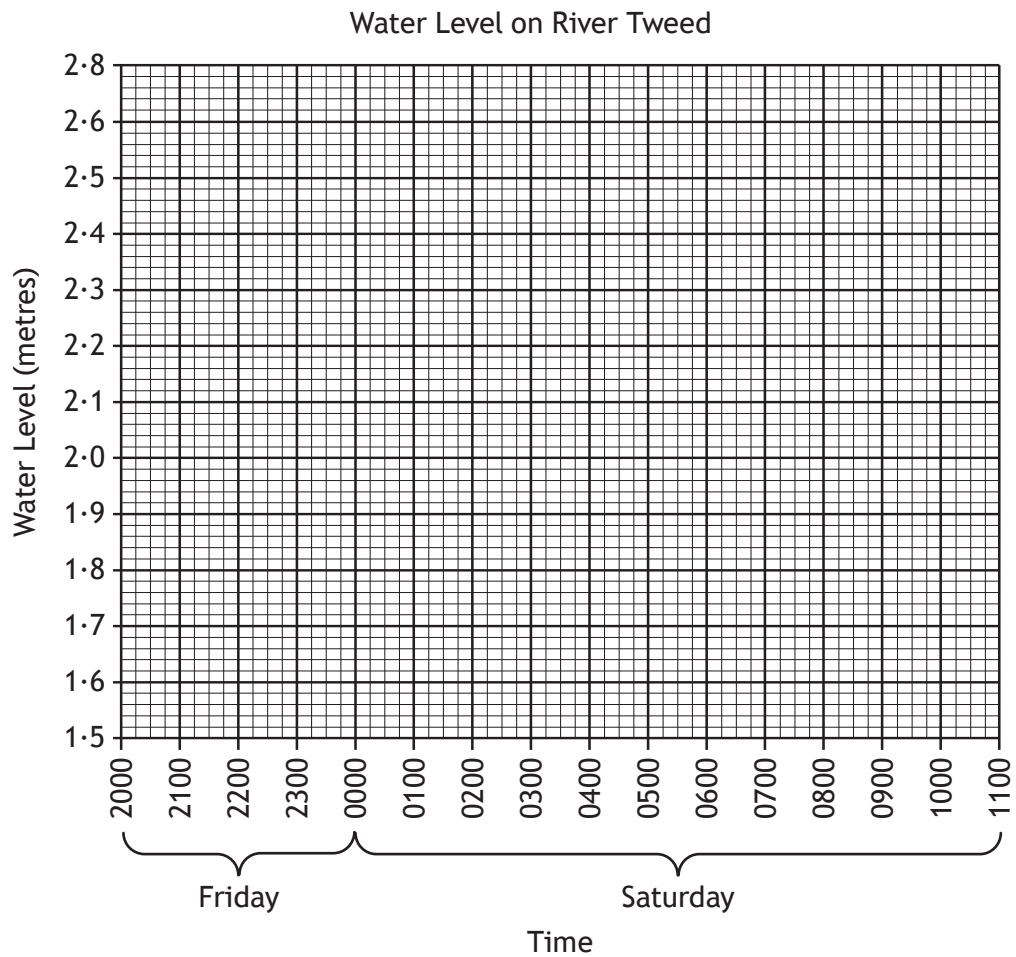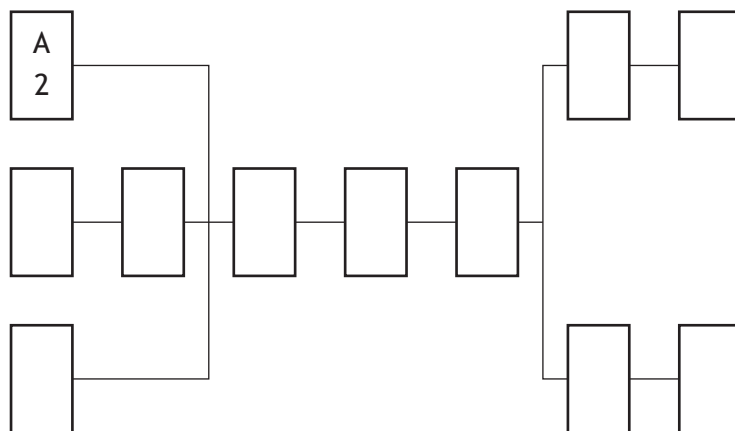
Water Level on River Tweed

Water Level (metres)

2·8
2·6
2·5
2·4
2·3
2·2
2·1
2·0
1·9
1·8
1·7
1·6
1·5

2000 2100 2200 2300 0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100

Friday　　　　　　　　　Saturday

Time

ADDITIONAL SPACE FOR ANSWERS

Additional diagram for Question 13 (b)

A
2

N5 National Qualifications SPECIMEN ONLY

S844/75/01

Applications of Mathematics
Paper 1 (Non-Calculator)

Marking Instructions

SQA ©

General marking principles for National 5 Applications of Mathematics

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

For each question the marking instructions are generally in two sections, namely generic scheme and illustrative scheme. The generic scheme indicates the rationale for which each mark is awarded. The illustrative scheme covers methods which are commonly seen throughout the marking. In general, markers should use the illustrative scheme and only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.

(a)   Marks for each candidate response must <u>always</u> be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b)   Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

(c)   If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.

(d)   Credit must be assigned in accordance with the specific assessment guidelines.

(e)   One mark is available for each •. There are no half marks.

(f)   Working subsequent to an error must be **followed through**, with possible credit for the subsequent working, provided that the level of difficulty involved is approximately similar. Where, subsequent to an error, the working for a follow through mark has been eased, the follow through mark cannot be awarded.

(g)   As indicated on the front of the question paper, full credit should only be given where the solution contains appropriate working. Unless specifically mentioned in the marking instructions, a correct answer with no working receives no credit.

(h)   Candidates may use any mathematically correct method to answer questions except in cases where a particular method is specified or excluded.

(i)   As a consequence of an error perceived to be trivial, casual or insignificant, eg $6 \times 6 = 12$ candidates lose the opportunity of gaining a mark. However, note the second example in comment **(j)**.

(j) Where a transcription error (paper to script or within script) occurs, the candidate should normally lose the opportunity to be awarded the next process mark, eg

This is a transcription error and so the mark is not awarded.

Eased as no longer a solution of a quadratic equation so mark is not awarded.

$$x^2 + 5x + 7 = 9x + 4$$
$$x - 4x + 3 = 0$$
$$x = 1$$

Exceptionally this error is not treated as a transcription error as the candidate deals with the intended quadratic equation. The candidate has been given the benefit of the doubt and all marks awarded.

$$x^2 + 5x + 7 = 9x + 4$$
$$x - 4x + 3 = 0$$
$$(x - 3)(x - 1) = 0$$
$$x = 1 \text{ or } 3$$

(k) **Horizontal/vertical marking**
Where a question results in two pairs of solutions, this technique should be applied, but only if indicated in the detailed marking instructions for the question.

Example:

$$
\begin{array}{ccc}
 & \bullet^5 & \bullet^6 \\
\bullet^5 & x = 2 & x = -4 \\
\bullet^6 & y = 5 & y = -7
\end{array}
$$

Horizontal: $\bullet^5$ $x = 2$ and $x = -4$ Vertical: $\bullet^5$ $x = 2$ and $y = 5$
$\bullet^6$ $y = 5$ and $y = -7$ $\bullet^6$ $x = -4$ and $y = -7$

Markers should choose whichever method benefits the candidate, but **not** a combination of both.

(l) In final answers, unless specifically mentioned in the detailed marking instructions, numerical values should be simplified as far as possible, eg:

$\dfrac{15}{12}$ must be simplified to $\dfrac{5}{4}$ or $1\dfrac{1}{4}$ $\dfrac{43}{1}$ must be simplified to 43

$\dfrac{15}{0\cdot3}$ must be simplified to 50 $\dfrac{4/5}{3}$ must be simplified to $\dfrac{4}{15}$

$\sqrt{64}$ must be simplified to 8*****

*The square root of perfect squares up to and including 100 must be known.

(m) Unless specifically mentioned in the marking instructions, the following should not be penalised:

- Working subsequent to a correct answer
- Correct working in the wrong part of a question
- Legitimate variations in numerical answers/algebraic expressions, eg angles in degrees rounded to nearest degree
- Omission of units
- Bad form (bad form only becomes bad form if subsequent working is correct), eg $(x^3 + 2x^2 + 3x + 2)(2x + 1)$ written as $(x^3 + 2x^2 + 3x + 2) \times 2x + 1$

  $2x^4 + 4x^3 + 6x^2 + 4x + x^3 + 2x^2 + 3x + 2$ written as $2x^4 + 5x^3 + 8x^2 + 7x + 2$ gains full credit

- Repeated error within a question, but not between questions or papers

(n) In any 'Show that…' question, where the candidate has to arrive at a required result, the last mark of that part is not available as a follow-through from a previous error unless specified in the detailed marking instructions.

(o) All working should be carefully checked, even where a fundamental misunderstanding is apparent early in the candidate's response. Marks may still be available later in the question so reference must be made continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that the candidate has gained all the available marks.

(p) Scored-out working which has not been replaced should be marked where still legible. However, if the scored out working has been replaced, only the work which has not been scored out should be marked.

(q) Where a candidate has made multiple attempts using the same strategy and not identified their final answer, mark all attempts and award the lowest mark.

Where a candidate has tried different valid strategies, apply the above ruling to attempts within each strategy and then award the highest resultant mark.
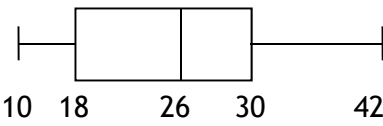
For example:

Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

In this case, award 3 marks.

Marking instructions for each question

Question			Generic scheme	Illustrative scheme	Max mark
1			**Ans: 7:30pm** •¹ Strategy: Know how to deal with flight time and time zone •² Process/communication: state time	•¹ Evidence of adding flight time and time zone •² 7:30pm	2
2			**Ans:** $\dfrac{3}{22}$ •¹ Identify correct values •² Process/communication: express as a fraction in its simplest form	•¹ Identify 9 and 66 •² $\dfrac{3}{22}$	2

Question			Generic scheme	Illustrative scheme	Max mark
3			**Ans: No, supported by working** •¹ Strategy: know to use upper/lower limits •² Process: calculate % outwith tolerance •³ Communication: state conclusion	•¹ Evidence of 2·35 and 2·45 (may be implied in ²) •² 17/20 = 85% •³ No, as 85% < 88%	**3**
			Alternative Strategy 1: •¹ Strategy: know to use upper/lower limits •² Process: calculate % outwith tolerance •³ Communication: state conclusion	•¹ Evidence of 2·35 and 2·45 (may be implied in ²) •² 3/20 = 15% •³ No, as 15% > 12%	
			Alternative Strategy 2: •¹ Strategy: know to use upper/lower limits •² Process: calculate minimum number needed for batch to be accepted •³ Communication: state conclusion	•¹ Evidence of 2·35 and 2·45 (may be implied in ²) •² 88% of 20 = 17·6, ie need 18 •³ No, as only 17 in tolerance, so batch fails	
4			**Ans: (£)7·26** •¹ Strategy: pick correct band •² Communication: pick consistent values from table •³ Process/Communication: conclusion	•¹ band F (could be implied by subsequent working) •² 76·13 and 145 •³ $2 \times 76\cdot13 - 145 = 7\cdot26$	**3**

Question			Generic scheme	Illustrative scheme	Max mark
5	(a)		**Ans: boys with valid reason**		1
	(b)		**Ans: 26, 18, 30** $\bullet^1$ Process: state the median $\bullet^2$ Process: state the quartiles	$\bullet^1$ 26 $\bullet^2$ 18, 30	2
	(c)		**Ans:** 10 18 26 30 42 $\bullet^1$ Strategy: correct end points $\bullet^2$ Strategy: correct box	$\bullet^1$ end points at 10 and 42 $\bullet^2$ box showing Q_1, Q_2, Q_3	2
6			**Ans: (£)764·40** $\bullet^1$ Process: calculate basic and overtime hours $\bullet^2$ Process: calculate overtime $\bullet^3$ Process: calculate gross weekly pay	$\bullet^1$ 40 and 6 $\bullet^2$ $6 \times 1\cdot5 \times 15\cdot60 = 140\cdot40$ $\bullet^3$ $15\cdot60 \times 40 + 140\cdot40 = 764\cdot40$	3
7			**Ans: 248 (Zloty)** $\bullet^1$ Strategy: know to divide by 30 then multiply by 4·96 $\bullet^2$ Process: all calculations correct	$\bullet^1$ Evidence $\bullet^2$ $1500 \div 30 = 50$ $50 \times 4\cdot96 = 248$	2
8			**Ans:** $\dfrac{13}{30}$ $\bullet^1$ Strategy: know to add fractions $\bullet^2$ Process: add fractions $\bullet^3$ Strategy/process: calculate fraction who walked to school	$\bullet^1$ evidence $\bullet^2$ $\dfrac{1}{6}+\dfrac{2}{5}=\dfrac{5}{30}+\dfrac{12}{30}=\dfrac{17}{30}$ $\bullet^3$ $\dfrac{13}{30}$ or equivalent	3

Question			Generic scheme	Illustrative scheme	Max mark
9			**Ans: 3 hours 45 minutes** •¹ Strategy: know how to find the time for 4 bakers •² Process: calculate time taken for 4 bakers •³ Communication: state time in hours and minutes	•¹ evidence •² $3 \times 5 \div 4 = 3 \cdot 75$ •³ 3 hours 45 minutes	3
10	(a)	(i)	**Ans: Points marked** •¹ Strategy: four points plotted correctly •² Strategy: remaining three points plotted correctly	•¹ Evidence •² Evidence	2
		(ii)	**Ans: Acceptable line of best fit drawn** •¹ Communication: line of best fit drawn	•¹ Evidence	1
	(b)		**Ans: No, with justification** •¹ Strategy: extend line of best fit and read graph •² Communication: give reason	•¹ Evidence •² No, as the height will only be 2·36 metres at 0830	2
11			**Ans: £163·75** •¹ Calculate selling price of the shares •² Calculates 2½% of selling price •³ Calculates amount she receives •⁴ Calculates loss	•¹ $200 \times 2 \cdot 75 = 550$ •² £13·75 •³ $550 - 13 \cdot 75 = 536 \cdot 25$ •⁴ $700 - 536 \cdot 25 = 163 \cdot 75$	4

Question			Generic scheme	Illustrative scheme	Max mark
12			**Ans: Yes, supported by working** •¹ Process: calculate gradient •² Strategy: know how to compare gradients •³ Communication: state conclusion consistent with working	•¹ 15/200 •² $15/200 = 0{\cdot}075$ •³ yes, $0{\cdot}06 < 0{\cdot}075 < 0{\cdot}08$	**3**
13	(a)		**Ans: (£)1011** •¹ Strategy: know to add semi-circle and 3 straight edges •² Process: calculate perimeter •³ Process: calculate cost	•¹ Evidence •² $\frac{1}{2} \times 3{\cdot}14 \times 20 + 20 + 8 + 8 = 67{\cdot}4$ •³ $67{\cdot}4 \times 5 \times 3 = 1011$	**3**
	(b)		**Ans: task letters and times inserted into chart** •¹ Strategy: start to allocate tasks •² Strategy: complete allocation of tasks	•¹ Any 7 boxes correct •² Remaining 4 boxes correct	**2**
	(c)		**Ans: no with reason** •¹ Strategy: select critical path •² Communication: state conclusion with reason	•¹ $2 + 4 + 2 + 1 + 2 + 1$ •² No, because it will take 12 hours	**2**

[END OF SPECIMEN MARKING INSTRUCTIONS]